

Methodological Challenges in Studying Trust in Natural Resources Management

Antonia Sohns ^{1,2,*}, Gordon M. Hickey ¹, Jasper R. de Vries ³ and Owen Temby ⁴

¹ Department of Natural Resource Sciences, McGill University, Montreal, QC H3A 0G4, Canada; gordon.hickey@mcgill.ca

² The Roux Institute, Northeastern University, 100 Fore Street, Portland, ME 04101, USA

³ Strategic Communication Group, Wageningen University, P.O. Box 8130, 6700 EW Wageningen, The Netherlands; jasper.devries@wur.nl

⁴ School of Earth, Environmental, and Marine Sciences, The University of Texas Rio Grande Valley, Brownsville, TX 78520, USA; owen.temby@utrgv.edu

* Correspondence: a.sohns@northeastern.edu

Abstract: Trust has been identified as a central characteristic of successful natural resource management (NRM), particularly in the context of implementing participatory approaches to stakeholder engagement. Trust is, however, a multi-dimensional and multi-level concept that is known to evolve recursively through time, challenging efforts to empirically measure its impact on collaboration in different NRM settings. In this communication we identify some of the challenges associated with conceptualizing and operationalizing trust in NRM field research, and pay particular attention to the inter-relationships between the concepts of trust, perceived risk and control due to their multi-dimensional and interacting roles in inter-organizational collaboration. The challenge of studying trust begins with its conceptualization, which impacts the terminology being used, thereby affecting the subsequent operationalization of trust in survey and interview measures, and the interpretation of these measures by engaged stakeholders. Building from this understanding, we highlight some of the key methodological considerations, including how trust is being conceptualized and how the associated measures are being developed, deployed, and validated in order to facilitate cross-context and cross-level comparisons. Until these key methodological issues are overcome, the nuanced roles of trust in NRM will remain unclear.

Keywords: trust; risk; control; natural resource management; stakeholder engagement; concept formation



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1. Introduction

In managing natural resources such as land or water, collaboration is often required between stakeholders across scales, and geographic and regulatory boundaries [1]. Participatory modeling and stakeholder engagement have been used as a means of better understanding complex resource problems and illuminating dynamic interconnections between social and ecological systems [2]. Through the iterative and interactive practice of participatory modeling, stakeholders construct models that represent their understanding of the system in question. Such understandings then contribute to the collective process and common understanding of the issue at stake and possible solutions.

In the context of natural resource management (NRM), constructed models often describe a natural resource and its use. The models depict the stakeholders' perception of the resource, the social, political, and economic aspects of their use, and the interaction between those variables [3]. In facilitating the development of models, many questions focus on "what modes of cooperation" are available to meet a management objective, and whether stakeholders feel there is an opportunity to participate in the process of solution development [4].

The results of modeling often identify social variables as central to whether a management approach leads to conflict or cooperation [5]. More specifically, many scholars indicate the importance of fostering the development of trust for long-term collaboration [6–9]. As such, trust has been identified as a central characteristic of successful natural resource management [10].

Trust is often perceived as a complex property that develops in relationships. One of the chief paradigms of trust is that it is interpersonal, developing between two people, although there are also forms of trust that develop in group or network contexts, in government, in institutions, or in oneself [11]. Trust generally requires a person to become vulnerable to betrayal or opportunism of the person who or entity that holds their trust [12,13], and to rely on a person to be competent at what they have been trusted to willingly do [14]. Trust is therefore an act of risk taking [15], and a type of reliance, but is not only reliance [11,16]. Reliance is defined as a three part relation, where A relies on B to perform an act or ensure a state C [17]. Reliance may be voluntary or involuntary, and if C is not achieved by B, then it is conceptualized that A may feel let down, but not betrayed [11,17]. Reliance is often viewed as a prerequisite for trust, and is required for the continuation of a relationship based on one partner's dependable habits toward the other [18,19]. What distinguishes trust from reliance continues to be a focus of researchers who seek to determine what motivates trust [11], and how trust relates to other multi-dimensional, complex concepts, such as risk and control [17,20,21], underlining the complex nature of trust in research and practice.

Due to the complexity and plurality of trust, it is at times described as an individual quality, and at other times conceptualized as a component of social capital [22,23]. Trust is also described as an outcome, where stakeholders have trust, compared to it as a quality, looking at how people trust. In this communication article, we define trust as the extent to which a person is willing to accept risk based on the positive expectations of the intentions of behavior of the other party, 'irrespective of the ability to monitor or control that party' [24]. We discuss several types of trust, including the four trust types described by Stern and Coleman [21] considered relevant to collaboration in NRM: rational trust, procedural trust, affinitive trust, and dispositional trust. Dispositional trust can be described as a predisposition to trust independent of context [21]. Procedural trust, or systems-based trust, is based on the interactions between control systems and types of trust [21,24]. Affinitive trust can develop through an evaluation of character or subconsciously due to the personality or charisma of the potential trustee. Rational trust emerges from 'calculative expectations of personal benefits' [21]. These trust types exist within the broader definition of trust, representing interacting dimensions across different levels, from individual to system.

Increasing attention towards trust indicates the central role it plays in the management of common pool resources, particularly in the interactions between policy actors and institutions [23,25]. Previous research has emphasized that trust is vital to collaboration [15,23,26–28], and that it serves as a critical component to communication, attenuating conflict, and encouraging compliance with regulations [15,29–32].

Despite the importance of trust to NRM and increasing scholarly attention, there is still much unknown about the characteristics and types of trust, how trust develops and may be facilitated, and how types of trust influence collective action [23,25]. Many existing empirical studies seeking to examine trust in different NRM contexts often fail to adequately define trust, do not treat it as a multidimensional concept, nor assess trust's antecedents and stages of development to inform management strategies [33]. Indeed, studies continue to struggle methodologically around trust's conceptualization and operationalization. This lack of clarity confounds efforts to deepen understanding of trust's role in NRM and collaboration through stakeholder engagement, interviews, and surveys.

In what follows, we focus on some of the challenges associated with operationalizing trust in NRM research, and pay special attention to the inter-relationships between the concepts of trust, perceived risk, and control due to their multi-dimensional and interacting

roles in inter-organizational collaboration [20,33]. Our aim is to highlight some of the key methodological issues affecting recent empirical trust research, drawing from studies that have adopted a multi-dimensional perspective based on the conceptual work of Das and Teng [20] and Stern and Coleman [21]. This short communication is, therefore, not a systematic review of all empirical trust research in the field of NRM, but rather a ‘snapshot’ focusing on several key methodological challenges obstructing insights to what motivates multi-dimensional trust and collaborative behaviors in NRM. By further refining how trust is being conceptualized and operationalized in stakeholder engagement and participatory modeling research, future opportunities to enhance multi-level understandings are likely to emerge. The following sections therefore discuss several key challenges to studying trust, and the implications for how trust has been previously operationalized through interview and survey questions.

2. Challenges to Measuring Trust in Natural Resources Management

The challenge of studying trust begins with conceptualization, then impacts the terminology used, which affects subsequent operationalization of trust in survey and interview measures, and the interpretation of measures by engaged stakeholders. Those research findings then inform the future understanding of trust and how research studies conceptualize and then operationalize trust. Figure 1 depicts this circular relationship, highlighting some of the central methodological challenges affecting trust measures used in recent empirical studies.

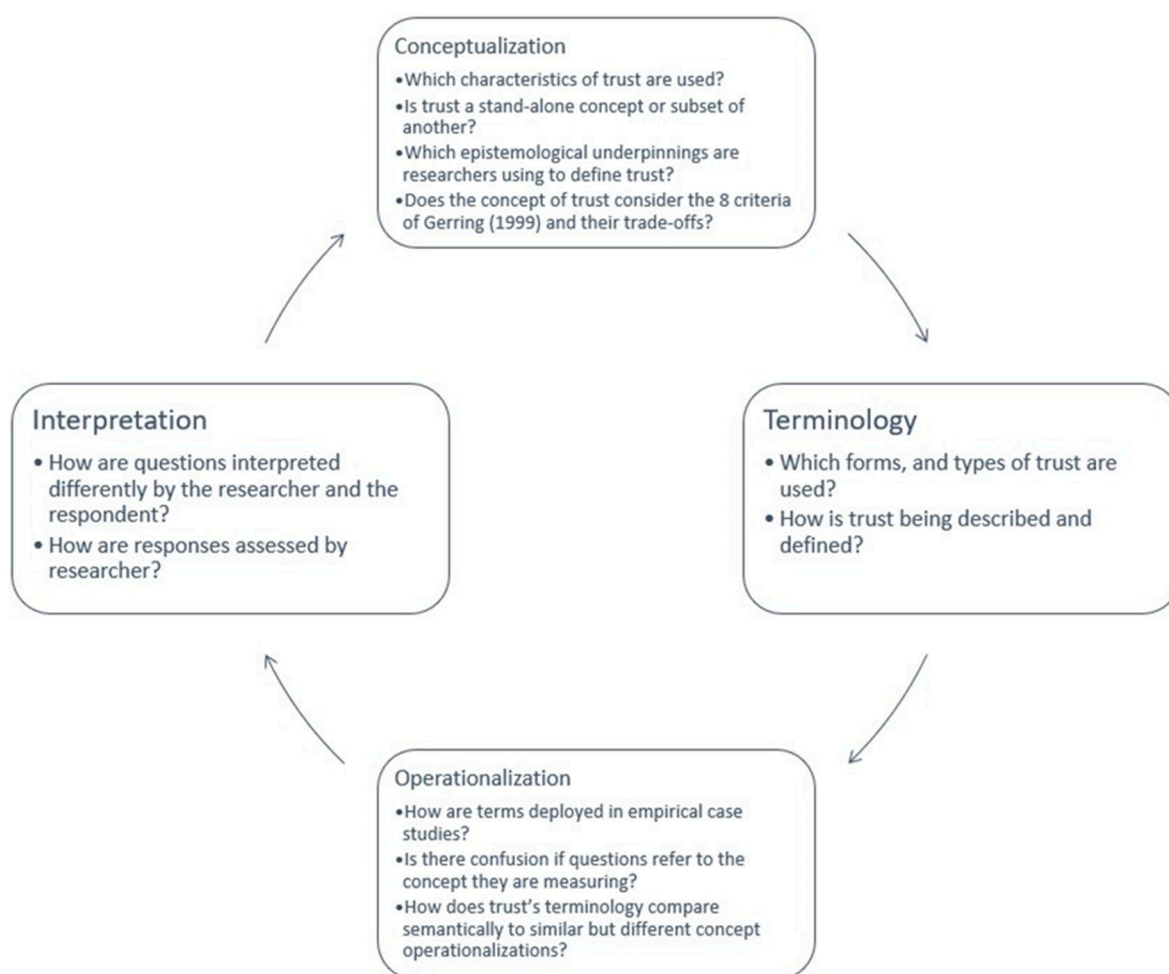


Figure 1. Methodological challenges facing trust measures.

2.1. Conceptualization

Looking at the conceptualization, Gerring [34] articulates eight criteria to consider when forming a concept: familiarity, resonance, parsimony, coherence, differentiation, depth, theoretical utility, and field utility. Of these, we were able to identify the criteria of familiarity and differentiation as being particularly relevant to the conceptualization of trust in NRM settings.

2.1.1. Concept Familiarity

One of the central issues affecting trust's measurement in the studies reviewed is that it is a familiar concept to stakeholders. Many empirical studies that seek to examine trust in NRM use the concept in a sentence or phrase posed directly to respondents, such as "how much do you trust the stakeholders [listed] below" [35]. Other studies have asked if people in the community are "trustworthy," if stakeholders "trust others" [28], if stakeholders "trust ... managers" [36], if most people in society can be trusted [37,38], and what the respondent's "trust level in government" is [38]. Although these studies draw interesting conclusions on trust levels, they do not explicitly articulate the different understandings of trust. Since trust is a word that is used widely in society and is a familiar concept to people, it may be understood differently depending on the person, the context, and the network being discussed. Trust as a concept and which types of trust are being investigated in a specific study may not match the everyday usage or language around trust, resulting in an unclear concept [34]. The dissonance between how trust is understood by the researcher and the stakeholder responding to the statement needs to be a central concern during problem framing and problem definition, at the start of the survey, interview, or participatory modeling process. It is therefore difficult to ensure that the meaning of "trust" is shared by the respondent and the researcher. Statements seeking to measure trust in NRM through stakeholder engagement could be improved if they more clearly identified the characteristics of trust they were specifically interested in related to specific types of trust instead of using the word trust to measure the concept.

2.1.2. Concept Differentiation

The measurement of trust is challenged by how researchers are examining stakeholders' beliefs and values tied to trust compared to closely related theoretical constructs. In many of the empirical studies examining trust, components of trust are being measured as part of a broader concept, such as social capital, or in how trust is influenced by other concepts, such as risk. Researchers have long assessed trust through social capital, identifying that where there is a high level of trust, there is more willingness to cooperate in the use of common goods [32]. Due to the multidimensionality of trust, and it being a complex concept, it is hard to define it and use its dimensions in a mutually exclusive way. Feist et al. [9] describe the importance of trust building, relationship building, and building respect to collaboration, and note that at times those qualities were also described as a part of social capital. In their paper, social capital is defined as both an outcome and as a quality, as "relationships of trust, norms of reciprocity, and networks among individuals that can be drawn upon for an individual or a collective benefit" [9]. Past assessments of trust measures have found 129 different measures of trust, and 38 conceptual constructs within those measures, across 171 papers [39]. The many types of trust may also be termed differently between papers. For example, He et al. [38] examine government trust and social trust, where other studies may define trust in government as procedural trust, institutional trust, or systems trust and social trust as affinitive trust, mutual trust, or dispositional trust. This leads to conceptual unclarity and limits the possibilities for comparisons between studies, and the development of a coherent body of knowledge within the NRM field.

A second key challenge in current NRM literature on trust is differentiating trust from the interrelated concepts of perceived risk and management control due the role these three concepts have in determining the outcome of collaborative relationships and how the concepts dynamically influence one another over time [20,33]. In the context of trust

and risk, there is a long relationship between the two concepts due to their fundamental connection—of a person willing to accept risk by entering into a relationship with another party. Risk is therefore embedded in trust research, and trust is integral to risk management. A study exploring the presence of trust in risk studies found many trust-related constructs across 132 studies, and found that most could be categorized as either relational trust (the trust between person A and B), or calculative trust (based on past behavior of the other, and constraints on behavior) [40].

The statements posed by researchers to stakeholders often occupy a similar semantic space, which underscores the challenge of differentiating trust from the similar yet different concept of risk. Figure 2 highlights characteristics of trust or risk that were explicitly identified by empirical case studies in the articles' description of the concept, trust or risk. Each box in Figure 2 is drawn from the "characteristics" columns identified in Table 1. The inner column of the Figure reveals characteristics from Table 1 that both trust and risk studies identified as underpinning their theoretical construct. Therefore, the Figure reveals areas of conceptual overlap between trust and risk. Both trust and risk share the quality that there must be something with an unknown outcome [11,41]. In the case of trust, a person is accepting vulnerability with a positive expectation of an outcome, and in the case of risk, a person's behavior is affected by the perception of the undesirable outcome occurring, such as a partner behaving in an undesired manner. This description tends to treat risk and trust as the inverse of one another, although they are not opposite concepts. The conceptual overlap between trust and risk highlights how trust is not sufficiently bounded from neighboring concepts. As a result, efforts to operationalize trust through statements that are similar in syntax and semantics to risk measures may complicate our ability to understand trust and further differentiate it from closely related yet different concepts [34].

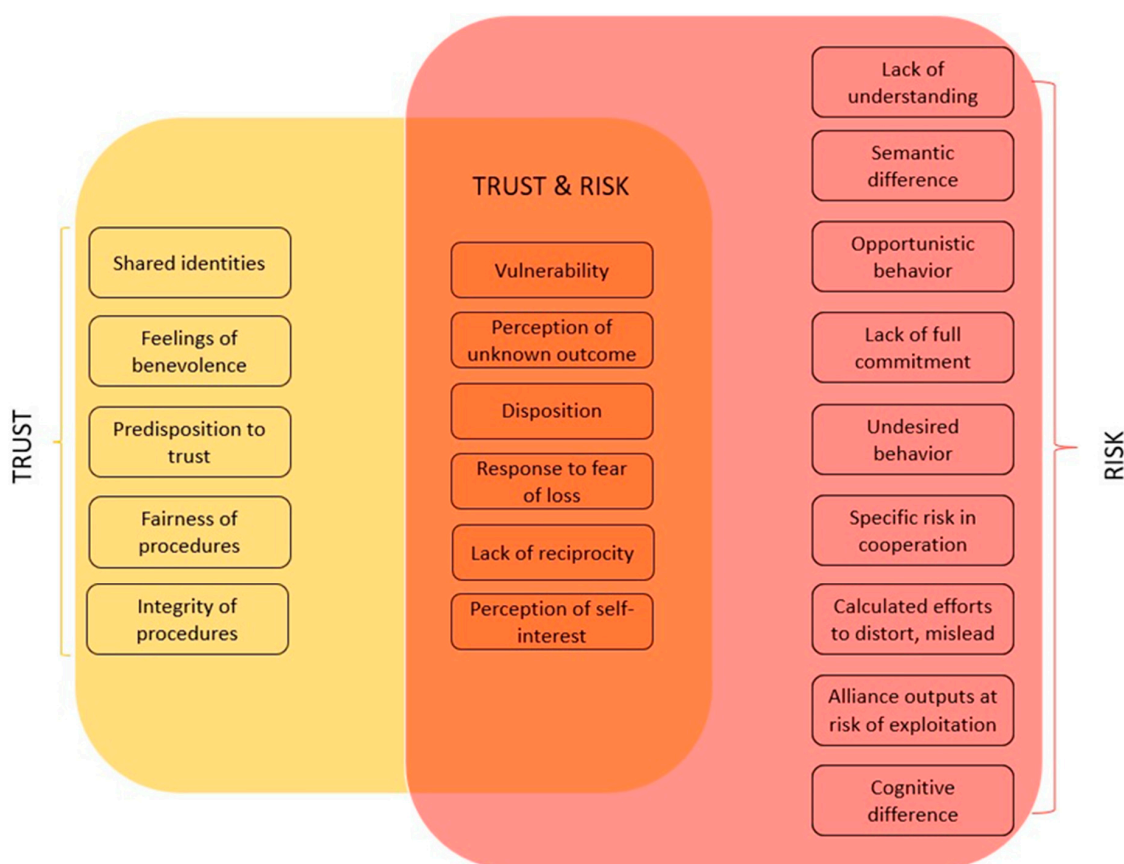


Figure 2. Underlying characteristics of trust and risk as described by empirical studies. Yellow represents trust, red represents risk, and orange indicates the characteristics that were stated by the empirical study measuring trust or risk.

Table 1. Trust-risk examples. Column definitions: “Concept” states the designated theoretical construct being investigated by the empirical subject; “Statement” is the measure used in the empirical study’s survey or interview question; “Type” is the form of trust or risk identified by the empirical study; “Characteristic” is an attribute of the type of trust or risk as explicitly described by the empirical study.

Concept	Statement	Type	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4	Reference(s)
Trust	Because we have been working with this organization for so long, we can understand each other well and quickly	Affinitive Trust	Shared identities	Feelings of benevolence developed from longer-term interactions			[42]
Risk	Our partner expresses himself in a language which is close to ours	Incomprehension Risk	Lack of understanding	Semantic difference between partners	Cognitive difference between partners		[12,43]
Trust	Most people would try to take advantage of you if they got the chance	Dispositional Trust	Stable personality trait signaling a predisposition to trust another entity	Individual’s propensity to trust others			[23]
Risk	We think that this owner will take advantage of us when the opportunity arises.	Relational risk perceptions	Opportunistic behavior	Probability that a partner does not fully commit to alliance in desired manner	Probability that a partner does not behave in a desired manner	Specific risk in cooperative behavior	[13,44]
Trust	People are almost always interested only in their own welfare	Dispositional Trust	Stable personality trait signaling a predisposition to trust another entity	Individual’s propensity to trust others			[23]
Risk	On occasion, we lie about certain things in order to protect our interests	Relational risk perceptions	Opportunistic behavior	Probability that a partner does not fully commit to alliance in desired manner	Probability that a partner does not behave in a desired manner	Specific risk in cooperative behavior	[13,44,45]
Trust	You can’t be too careful dealing with people	Dispositional Trust	Stable personality trait signaling a predisposition to trust another entity	Individual’s propensity to trust others			[23]
Risk	Complete honesty does not pay when dealing with our partner	Perception of opportunistic behavior	Outputs of alliance may not be well-defined, as a result, firms may risk opportunistic exploitation by their partner	Calculated efforts to mislead, distort, disagree, obfuscate, or otherwise confuse			[12,43]
Trust	In our experiences with this organization, we have never had the feeling of being misled	Procedural Trust	Fairness of procedures	Integrity of procedures			[42]
Risk	Our partner have always provided us a completely truthful picture of their business	Perception of opportunistic behavior	Outputs or profits of alliance may not be well-defined, as a result, firms may risk opportunistic exploitation by their partner	Calculated efforts to mislead, distort, disagree, obfuscate, or otherwise confuse			[12,43]

Despite the similarities between trust and risk, the concepts differ in many ways, such as how individuals perceive and react to an unknown outcome and how they respond to the fear of loss. People may experience risk and trust loss or gains differently, or be uniquely risk-averse or trust-prone based on personal experiences or history. Trust and risk also differ in their reference to personal and professional histories. Due to individual responses around the sense of loss, different measure of trust may refer to similar emotions based on past experiences of broken promises, unmet objectives, or lack of reciprocity, operating at organizational or individual levels. Those differences, and the similarities between trust and risk, need to be further considered in stakeholder engagement and participatory modeling research because the conceptual overlaps lead to operationalization

that muddies the findings. Studies could explore the relative differences between trust and risk in order to better establish boundaries between them, such as which conceptual attributes are always, sometimes, or never found in the concept [34].

In other empirical studies, efforts to measure trust are complicated by trust's conceptualization as an informal mechanism of control [12,46]. For the purpose of this short communication, control is defined as a process of regulation and monitoring for the achievement of organizational goals through modes of formal or social control over the partner, or over the alliance [20]. The mechanisms of control have distinct impacts on the types of trust. As Table 2 highlights, nesting trust within control can lead to overlap between the characteristics that underpin these two concepts. Figure 3 presents the areas of overlap between the underlying characteristics of trust and control described by the empirical studies reviewed. Each box in Figure 3 is drawn from the characteristics identified in Table 2 that were identified by authors as underpinning the associated theoretical construct.

Table 2. Trust-control examples. Column definitions: “Concept” states the designated theoretical construct being investigated by the empirical subject; “Statement” is the measure used in the empirical study’s survey or interview question; “Construct” is the form of trust or control identified by the empirical study; “Characteristic” is an attribute of the type of trust or control as explicitly described by the empirical study. The yellow cells highlight overlapping characteristics between trust and control that were identified in the different empirical studies.

Concept	Statement	Construct	Characteristic 1	Characteristic 2	Characteristic 3	Characteristic 4	Characteristic 5	Reference(s)
Trust	Members share the same value	Shared vision	Shared goals	Shared culture	Shared values	Hypothesized to reinforce cooperation		[44]
Control	We chose this partner because our culture is compatible with his	Informal autonomous instruments of control	Shared goals	Shared culture	Shared values	Hypothesized to reinforce cooperation	Organizational norms	[12]
Trust	I feel that I can influence the fisheries management process	None identified		Social control				[36]
Control	Our party has the ability to influence the common vision	Control ability	Behavioral control	Social control	Output control			[44]
Trust	The alliance is characterized by high reciprocity among the partners	Relational capital	Goodwill of others	Develops from repeated alliance with partners	Emotional investment in others	Friendship	Mutual respect	[12,43,47]
Control	We feel that by going along with this owner, we would be favored on other occasions	Mediated power	Relies on rewards/punishments, or legal/contract terms	Coercive power				[13,48]
Trust	There is close, personal interaction between the partner at multiple levels	Relational capital	Goodwill of others	Develops from repeated alliance with partners	Emotional investment in others	Friendship	Mutual respect	[7,12,43]
Control	We cooperate closely with this owner in the implementation process of this project	Solidarity	High value on relationship	Shared expectations	Shared values	Friendship		[13,49]
Trust	The alliance is characterized by personal friendship between the partner at multiple levels	Relational capital	Friendship	Develops from repeated alliance with partners	Emotional investment in others	Goodwill of others	Mutual respect	[12,43,47]
Control	We have developed personal as well as business relationships with this owner	Solidarity	Friendship	Shared expectations	Shared values	High value on relationship		[13,49]

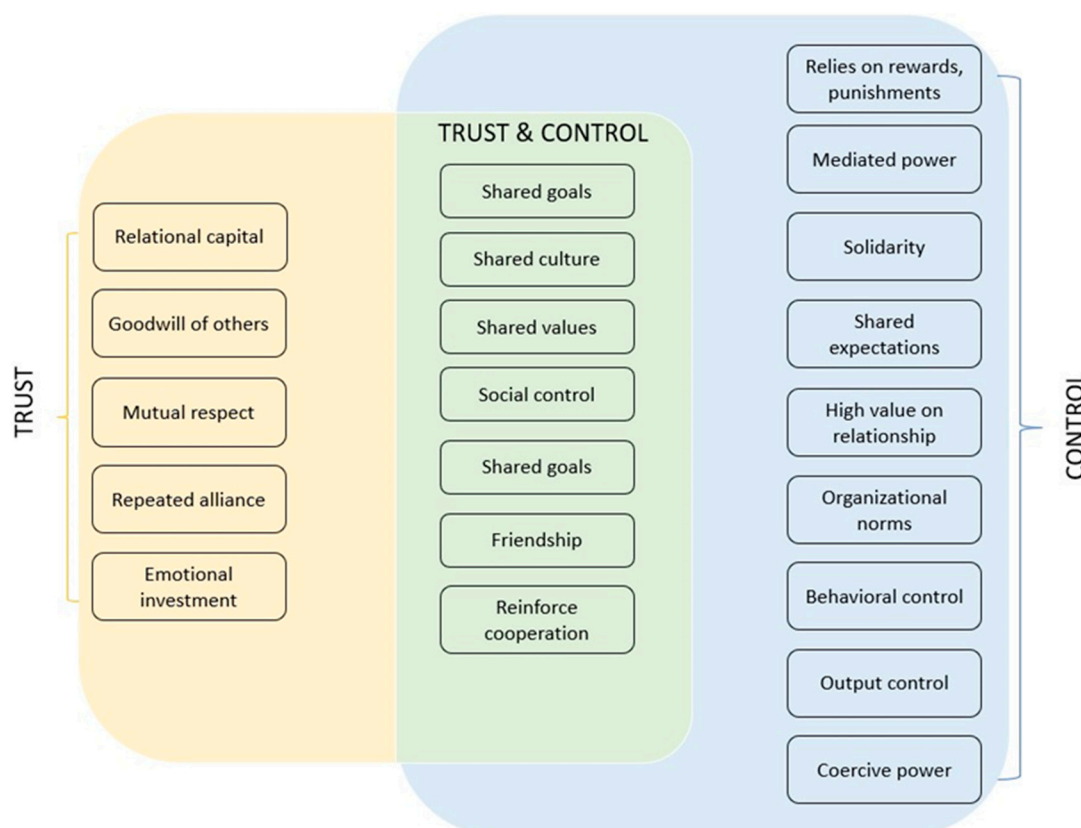


Figure 3. Underlying characteristics of trust and control as described by empirical studies. Yellow represents trust, blue represents control, and green indicates the characteristics that were stated by the empirical study measuring trust or control.

For example, three of the statements related to trust and control (included in Table 2) show the cross-over between relational capital and solidarity, which results from authors' drawing on a similar conceptual underpinning of friendship. Researchers describe solidarity as a partner's sense of unity that binds it to another partner and is based on a friendly relationship between two sides [46]. Delerue [12] describes relational capital as a developed form of trust based on repeated alliances between the same partners, that is an emotional investment developed on the belief in the goodwill of others, mutual respect, and friendship. Despite the similarity between relational capital and solidarity, the two concepts diverge in their view of the past or future as influencing trust or risk. Researchers have conceptualized relational capital with a view towards the past, emphasizing the history and outcome of relationships between partners, whereas solidarity seems to be more forward looking, with parties looking at how shared values affect future orientation [13]. Future research could therefore explore these perceptions of past and future, and how they influence trust dynamics in relationships. At present, empirical case studies generally fall short of teasing out the types of trust and control as distinct multi-dimensional concepts. Such conceptual issues adversely affect how trust and control are operationalized and our subsequent understanding of the results.

2.1.3. Trust over Time and Across Scales

A further methodological challenge that has yet to be fully grappled with is that trust, as well as its related concepts, evolves recursively during the period of collaboration and therefore will vary over time. A number of existing studies have treated trust as a static concept, likely missing the dynamics of how trust evolves among actors, as it is lost and regained, nurtured, or eroded based on current and past experiences [50–53]. Some researchers have explicitly examined how trust changes over time, such as PytlikZilg's article examining the stages of institutional trust as knowledge about an institution

changes and affects one's attitudes towards it [26]. Future stakeholder engagement and participatory modeling research should build on this work to closely monitor how trust causes, moderates, and affects elements of a relationship over time [54]. In doing so, new insights could emerge on how trust impacts relationship phases, development processes, and evolutionary dynamics [54,55]. Longitudinal research will be important as certain types of trust develop at different rates and evolve over time [21].

Not only is it critical to study trust development over time, but it is also key to consider what level of trust is being examined. Trust operates at different scales in a collaborative relationship, from the individual to the alliance level, as well as the systems level where trust works through normative and legal superstructures that constrain interpersonal behaviors and affect social systems [21,54,56]. Studies have revealed the unique aspects of trust, such as reciprocal trust and trust formation, that occur at the team and inter-team levels [51]. By investigating a specific level of trust or by using a multilevel lens, it becomes possible to incorporate contextual, systemic, institutional, interpersonal, and individualistic elements of trust and therefore deepen insights into the mechanisms of social behavior and how it may affect collaborative relationships [53,54]. Further refinement of trust measures may help to ensure that statements seeking to examine trust or risk in relationship are not too similar as to stymie multi-dimensional and multi-level understanding of trust and its components compared to other multi-level and multi-dimensional concepts.

2.2. Operationalization

Problems with conceptualization have often challenged the operationalization of trust measures. Tables 1 and 2 detail the concept that authors identified they were seeking to measure, the statement that acted as the measure presented to survey or interview respondents, the concept type or construct, if identified by the authors, and the underlying characteristics of the concept type or construct that were described by the authors. The yellow-colored cells in Table 2 highlight the shared characteristics between concepts.

Generally, the richest trust studies are those that use interview and survey items to measure trust's unique characteristics and how it is at work in a relationship. Rarely does an individual wholly or simply trust another person or another entity [11]. Instead, trust tends to be tied to a certain action that a person trusts another to do with a level of competence and willingness. Certain types of trust can therefore be seen as a three-part relation, where A trusts B to do X instead of a two-part relationship where A trusts B [11]. For example, empirical studies investigating institutional trust have teased out aspects of the "institution" that are trusted, through measures such as, "I have confidence in X to do their jobs and perform their functions as they should" [57], and "there are plenty of reasons to believe that the leaders and staff . . . are motivated to do their jobs and fulfill their responsibilities" [57]. However, many measures of institutional trust have assessed the degree of confidence one has in whether the institution will perform its job, acting more as an assessment of the institution than a source of insight regarding the nuances of the trust relationship [58]. Stakeholder engagement and participatory modeling research involving the concept of trust could benefit from clearly articulating what aspect of a given relationship a person trusts, or what key tasks a person trusts to be carried out by a given partner, instead of inquiring if the respondent trusts another person or entity completely [59].

Interestingly some studies that seek to measure trust do not define trust or investigate its nuances, while appreciating the complexity and multi-dimensionality of other concepts in their interview or survey items, such as ecosystem services, livelihoods, and adaptive capacity [35]. In these cases, the researchers often use a reference to describe the variable, such as the number of organizations they belong to as representing the bonding network, or the number of people a person knows in their neighborhood as indicating bridging network [37]. In O'Leary et al [28], as the authors seek to assess "agency in the community", the concept "agency" is not used, instead the characteristics that comprise agency are examined through the questions, such as gauging a respondent's ability to influence

decisions in their community, whether the respondent has control over decisions, or if the respondent perceives that the community supports their learning and development. Trust measures need to be operationalized similarly, designed to elicit aspects of the relationship, or features of the type of trust that are being examined.

Due to overlap during conceptualization, the way that trust and perceived risk are operationalized in studies can result in lexical and semantic overlap, as highlighted in the statements of Table 1. For example, Song et al. [23] use the statement, “most people would try to take advantage of you if they got the chance” to measure dispositional trust, whereas Zhang et al. [13] use the question, “we think that this owner will take advantage of us when the opportunity arises” to measure the risk that a party does not behave in the desired manner. These questions target different concepts of trust and risk and use similar phrasing, drawing on the underlying idea of opportunism.

In the context of trust and control, the overlap between concepts confounds our ability to tease apart the role that trust, control, or their dimensions have on collaboration and NRM, and their dyadic relations. As seen in Table 2, issues during conceptualization manifest in how trust and control measures are operationalized. For example, Zhang et al. [44] ask respondents whether “members share the same value” in order to measure trust, whereas Delerue [12] ask respondents whether they “chose this partner because our culture is compatible with his” to measure control. Although Delerue [12] and Zhang et al. [44] are examining different concepts through these questions, both studies identify shared culture, shared values, and shared goals as characteristics of trust and control, respectively. The impact of semantic overlap on stakeholders responding to the interview and survey questions needs to be further examined to determine how it impacts researcher understanding of different trust dimensions. For example, in conducting a basic sentiment analysis via Monkey Learn (2021), the questions presented in Tables 1 and 2 were interpreted to be negative in measuring control with 82 percent confidence, positive in measuring trust 85.5 percent confidence, and positive in measuring risk with 71.2 percent confidence. Sentiment analysis detects emotions and opinions in the structure of the text, with Monkey Learn’s algorithm identifying semantic techniques to determine meaning and then classifying the text as positive, negative, or neutral. It is interesting that researchers’ questions developed for risk are largely positive with respondents then ranking whether they agree or disagree with the statement. Such phrasings could be for statistical analysis purposes, such as reverse scoring, but methodologically it could be important to consider the extent to which positive, negative, or neutral phrasing affect how dimensions of risk, trust, or control are measured in the context of collaboration. Questions could include whether it affects the respondents’ sentiment in answering the questions, or if those phrasings represent sentiments tied to researchers’ existing emotional perspective related to the concepts.

3. Conclusions

A review of the issues affecting trust measurement in organizational research by McEvily and Tortoriello [39] identified basic and fragmented approaches to measuring trust, a lack of accuracy in replication, limited evidence of construct validity, and a tendency to treat trust as a uni-dimensional construct, concluding that the ‘state of the art’ of trust measurement was rudimentary and increasingly fragmented. Our findings suggest these issues remain salient to NRM trust scholarship today, with lessons for future stakeholder engagement and participatory modeling research concerned with collaboration. For example, a practical step before operationalizing could be clearly articulating what trust is not (terminology). When operationalizing trust, carefully specifying the three-part relationship of trust, where A trusts B to do X, could also be helpful. As well as clarifying the temporal scale, such as exploring the current state of trust or how trust develops over time. As with other complex and multi-dimensional concepts, resolving the challenges will be an iterative process. Nevertheless, until the key methodological issues are overcome, understanding the role of trust in NRM will remain murky. Key concerns we identified include how trust

is being differentiated from closely related concepts, and how stakeholders may differently understand the trust terms being used during data collection. Ultimately, there is a need for a cumulative body of work based on accurate, reliable, and valid instruments that can facilitate comparisons across levels and contexts [39]. Paying greater attention to how trust measures are being developed, deployed, and validated, combined with efforts to ensure conceptual clarity, offer a clear starting point.

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